Supporting maritime forecast with Sentinel-1 satellite Near Real Time services: observations of wind, sea sate and coastal processes

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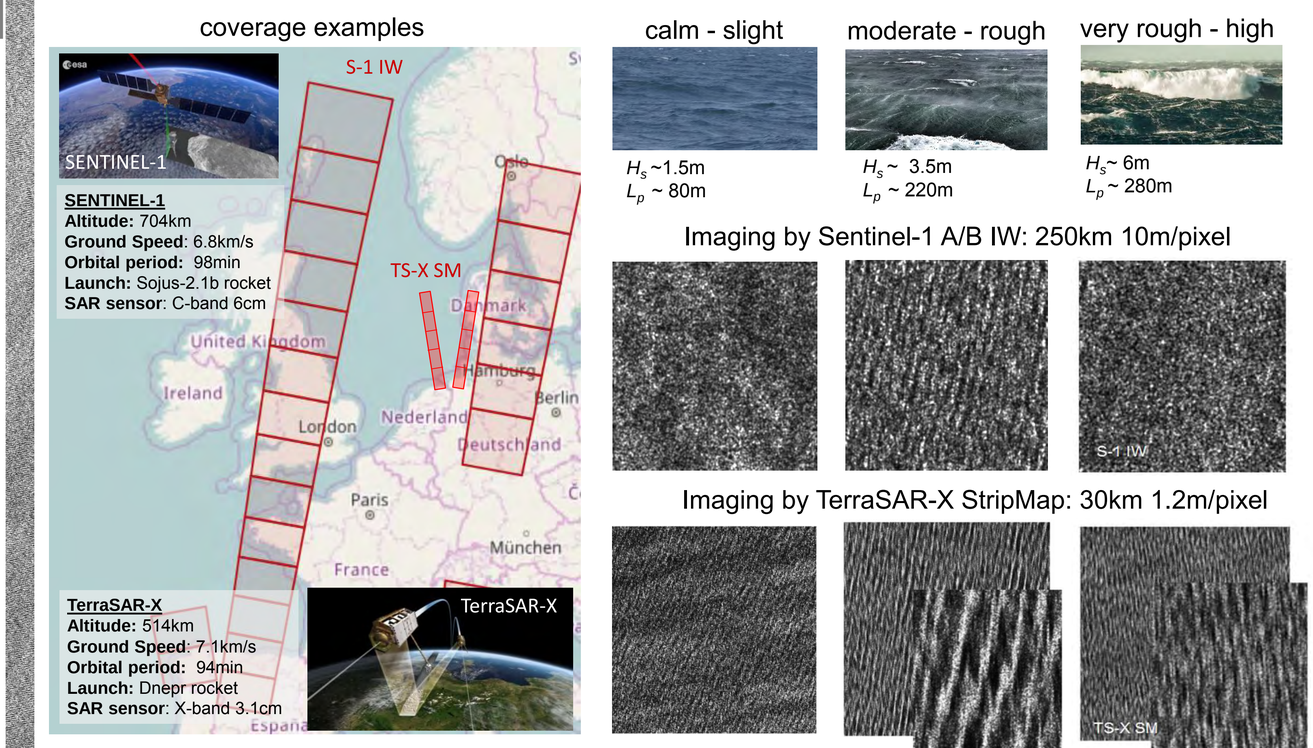
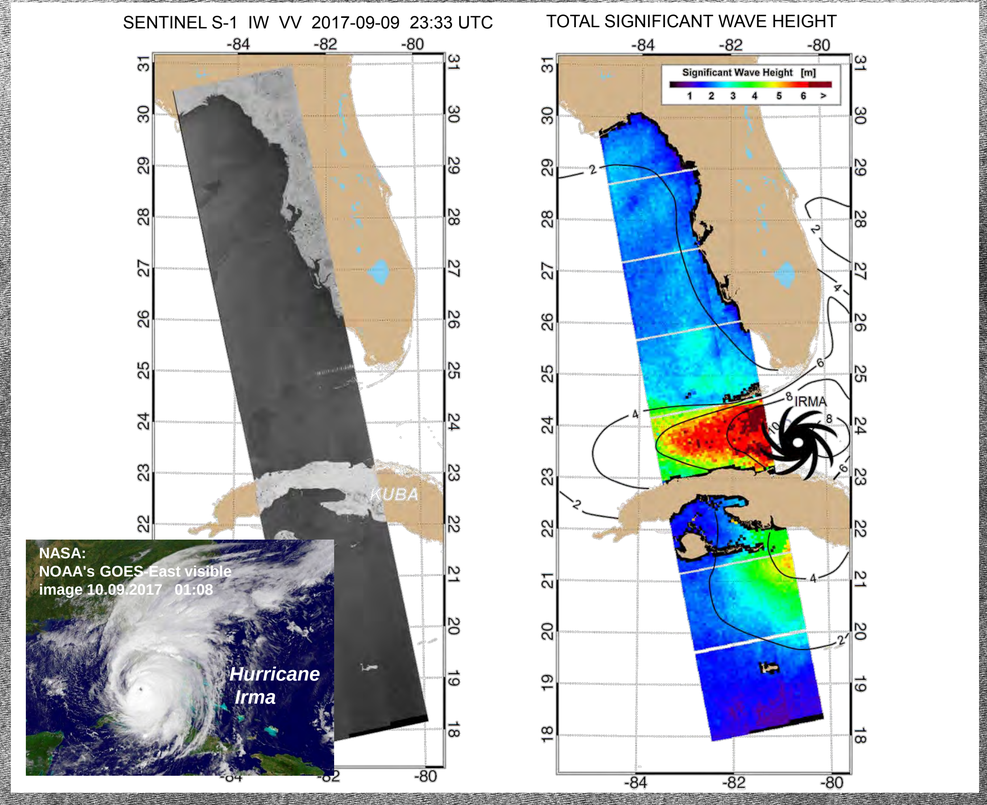
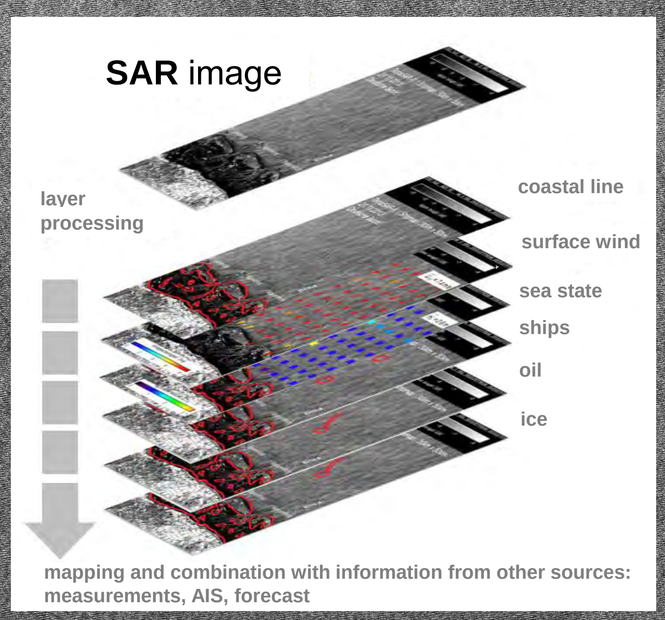


The differences of sea state imaging by different sensors. A new empirical algorithm for estimation of total significant wave height from C-band satellite-borne Synthetic Aperture Radar (SAR) data has been developed for SENTINEL-1 (S-1) Interferometric Wide Swath Mode (IW) imagery.

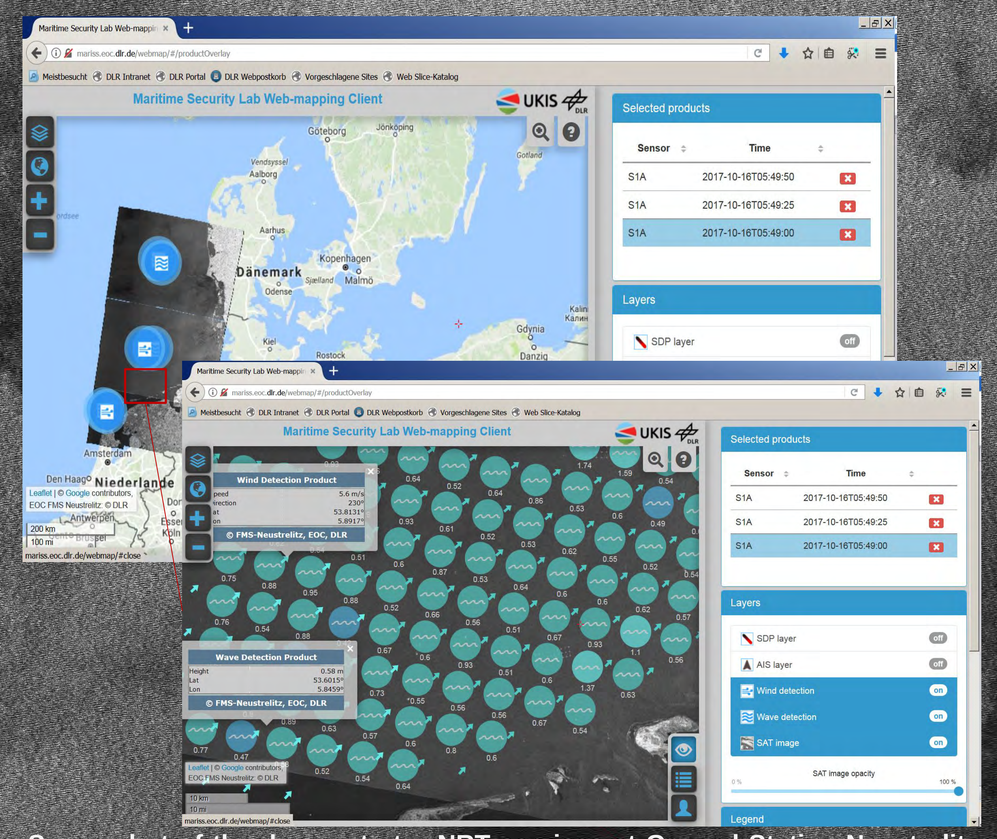


Total significant wave height estimated from a Sentinel-1 IW images acquired over Cuba and Florida on 09.09.2017 at 23:33 UTC during hurricane Irma was moving towards Golf of Mexico. The isolines present the WWIII model results.

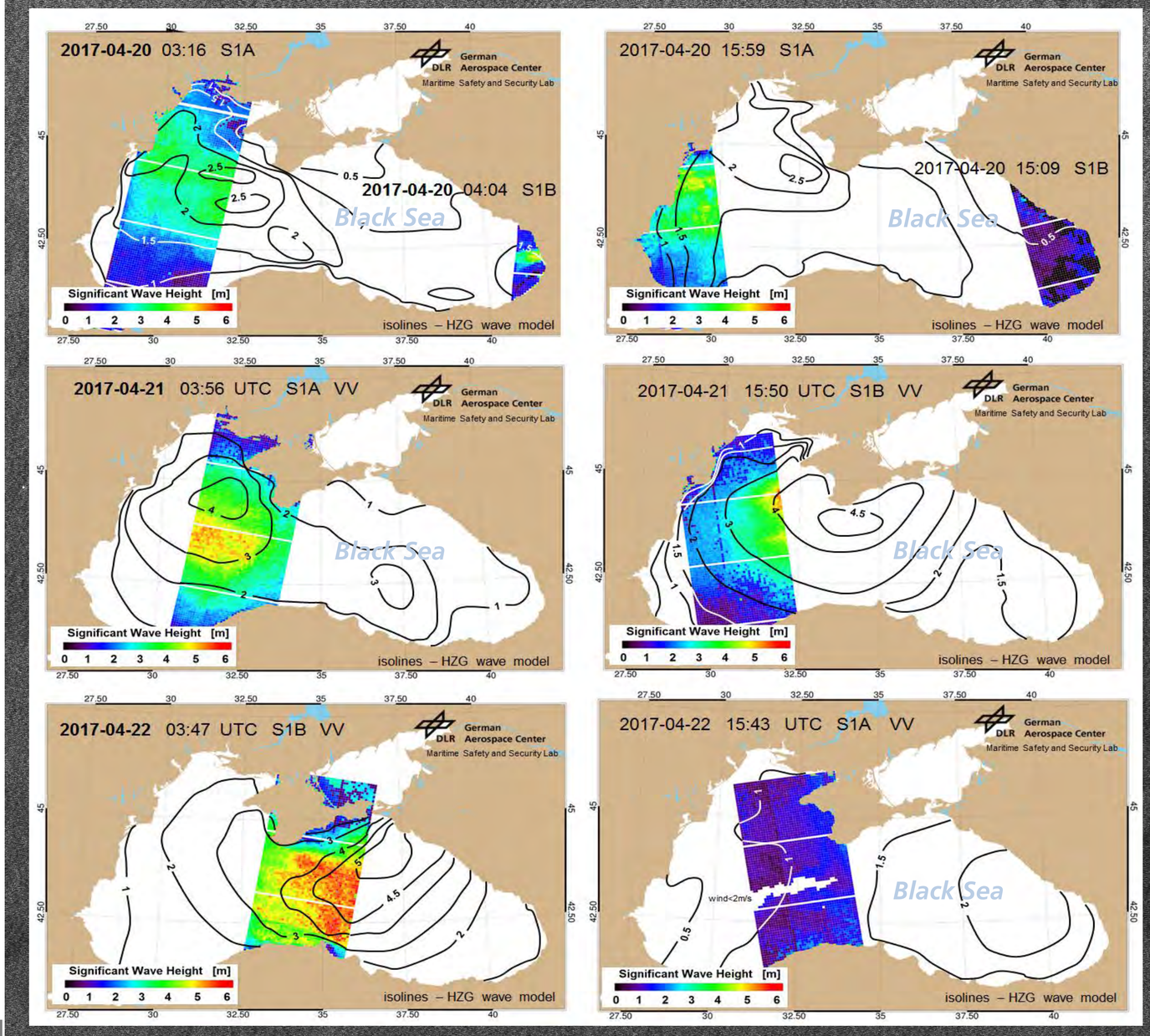


Processing of a SAR image for maritime situation awareness (MSA). Information from different layers are shared to each other to improve accuracy.

Innovative algorithms for meteo-marine parameters estimation are integrated into a prototype processor for Sentinel-1 SAR imagery. The DLR Ground Station Neustrelitz applies this prototype as part of a near real-time (NRT) demonstrator service for support of Maritime Situation Awareness. The presented scientific service involves daily provision of surface wind and sea state parameters estimated full automatically from Sentinel-1 Interferometric Wide Swath (IW) SAR (Synthetic Aperture Radar) images for North and Baltic Sea.



Screenshot of the demonstrator NRT services at Ground Station Neustrelitz. The developed algorithms are included into an integrated processor and implemented into the NRT server chain. The maritime environment: wind (arrows) and sea state (circles) and ship detection products are combined in layers. The demonstrator runs daily for Sentinel-1 IW in Southern North Sea and Western Baltic Sea.



An example of storm tracking in the Black Sea in April 2017 over three days (Sentinel 1 A/B IW).

An example of efficient storm tracking in the Black Sea in April 2017 over three days. The HZG forecast spectral wave model running for the Black Sea reproduces the storm peak propagation near to the S-1 observations.
In detail, the storm peak observed by S-1 is shifted ~80km towards the south in comparison to the model simulations. During this storm, the ship “Geroi Arsenala” of river-sea class licensed for inland waterways with access to the coastal seas was capsized about 40 kilometres to the south of the Kerch Strait in the open Black Sea, according to the associated press. The cargo ship was carrying grain from Russia to Turkey.
Obviously, the course was taken too far from the coast to shorten the way across the sea with unexpected high sea state. Only one of the 12 people aboard was rescued.
This is a tragic incident that proves the importance of Maritime Safety and Security. With the Sentinel satellites and the processing framework demonstrated in this work, we have appropriate tools to raise Maritime Situation Awareness (MSA) to unprecedented levels, which helps avoiding such accidents.

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